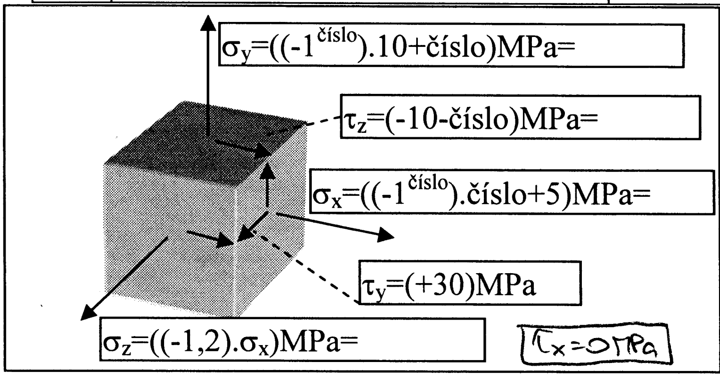
→ PARDON, 29 MINULÝ ROK, VŠIMLA JSEM SI, AŽ KDYŽ TO BYLO CELÉ SPOČÍTANÉ ...

1) vypočtěte $\sigma_1, \sigma_2, \sigma_3$ a jejich polohu
2) určete napjatost σ, τ – izometrické roviny.

číslo	Příjmení a jméno	napjatost
29		



$\sigma_y = ((-1^{29})\ 10 + 29)\ \text{MPa} = 19\ \text{MPa}$

$\tau_z = (-10-29)\ \text{MPa} = -39\ \text{MPa}$

$\sigma_x = ((-1^{29}).29 + 5)\ \text{MPa} = -24\ \text{MPa}$

$\tau_y = 30\ \text{MPa}$

$\sigma_z = ((-1,2)(-24))\ \text{MPa} = 28,8\ \text{MPa}$

$$\begin{bmatrix} \frac{1}{\sqrt3} \\ 1/\sqrt3 \\ 1/\sqrt3 \end{bmatrix}$$

$$\parallel$$

$$\begin{bmatrix} \sigma_x & \tau_z & \tau_y \\ \tau_z & \sigma_y & \tau_x \\ \tau_y & \tau_x & \sigma_z \end{bmatrix} \begin{bmatrix} \cos\alpha \\ \cos\beta \\ \cos\gamma \end{bmatrix} = \begin{bmatrix} p_x \\ p_y \\ p_z \end{bmatrix} \rightarrow \begin{bmatrix} -24 & -39 & 30 \\ -39 & 19 & \emptyset \\ 30 & \emptyset & 28,8 \end{bmatrix} \begin{bmatrix} 1/\sqrt3 \\ 1/\sqrt3 \\ 1/\sqrt3 \end{bmatrix} = \begin{bmatrix} -19,05 \\ -11,55 \\ 33,95 \end{bmatrix} \rightarrow p = \sqrt{p_x^2 + p_y^2 + p_z^2}$$

$$\boxed{p = 40,61\ \text{MPa}}$$

$\sigma = p_x \cos\alpha + p_y \cos\beta + p_z \cos\gamma = 1,93\ \text{MPa}$

$\tau = \sqrt{p^2 - \sigma^2} = 40,56\ \text{MPa}$

$$\begin{bmatrix} \sigma_x - \sigma & \tau_z & \tau_y \\ \tau_z & \sigma_y - \sigma & \tau_x \\ \tau_y & \tau_x & \sigma_z - \sigma \end{bmatrix} \begin{bmatrix} \cos\alpha \\ \cos\beta \\ \cos\gamma \end{bmatrix} = \begin{bmatrix} \emptyset \\ \emptyset \\ \emptyset \end{bmatrix} \rightarrow \det = \emptyset \rightarrow$$

$\sigma^3 - I_1\sigma^2 + I_2\sigma - I_3 = \emptyset$

$\sigma^3 - 23,8\sigma^2 - 3021\sigma + 74037,6 = \emptyset$

$(\sigma - k_1)(\sigma - k_2)(\sigma - k_3) = \emptyset$

$I_1 = \sigma_x + \sigma_y + \sigma_z = 23,8$

$I_2 = \begin{vmatrix} \sigma_x & \tau_z \\ \tau_z & \sigma_y \end{vmatrix} + \begin{vmatrix} \sigma_y & \tau_x \\ \tau_x & \sigma_z \end{vmatrix} + \begin{vmatrix} \sigma_z & \tau_y \\ \tau_y & \sigma_x \end{vmatrix} =$

$= \begin{vmatrix} -24 & -39 \\ -39 & 19 \end{vmatrix} + \begin{vmatrix} 19 & \emptyset \\ \emptyset & 28,8 \end{vmatrix} + \begin{vmatrix} 28,8 & 30 \\ 30 & -24 \end{vmatrix} =$

$= -1977 + 547,2 - 1591,2 =$

$= -3021$

$I_3 = \det(T_\sigma) =$

$$\begin{matrix} -24 & -39 & 30 \\ -39 & 19 & \emptyset \\ 30 & \emptyset & 28,8 \\ -24 & -39 & 30 \\ -39 & 19 & \emptyset \end{matrix}$$

$-13132,8 + \emptyset + \emptyset + -17100 - \emptyset - 43804,8 =$

$= -74037,6$

odhad k_1

σ	$f(\sigma)$	σ	$f(\sigma)$	σ	$f(\sigma)$
0	74037,6	25	-737,4	24,9	-503,269
1	70993,8	22	6704,4		
0,5	72521,275	24	1648,8		
0,1	73735,263	$\boxed{24,8}$	$\boxed{-268,16}$		
13	32939,4				

$(\sigma^3 - 23,8\sigma^2 - 3021\sigma + 74037,6) : (\sigma - 24,8) = \sigma^2 + \sigma - 2996,2$

$-(\sigma^3 - 24,8\sigma^2)$

$1\sigma^2 - 3021\sigma$

$-(\sigma^2 - 24,8\sigma)$

$-2996,2\sigma + 74037,6$

$-(-2996,2\sigma + 74305,76)$

$-268,16$

$\sigma_1 = 24,8$

$\sigma_2 = 54,2$

$\sigma_3 = -55,2$

1) $(\sigma_x - \sigma)\cos\alpha + \tau_z\cos\beta + \tau_y\cos\gamma = \emptyset$
2) $\tau_z\cos\alpha + (\sigma_y - \sigma)\cos\beta + \tau_x\cos\gamma = \emptyset$
3) $\tau_y\cos\alpha + \tau_x\cos\beta + (\sigma_z - \sigma)\cos\gamma = \emptyset$

$\rightarrow \cos\alpha = \dfrac{-\tau_z\cos\beta - \tau_y\cos\gamma}{\sigma_x - \sigma} = p \rightarrow$ 2) $\cos\beta = \dfrac{-\tau_z \cdot p - \tau_x\cos\gamma}{\sigma_y - \sigma}$ $\Rightarrow$?

3) $\cos\gamma = \dfrac{-\tau_y \cdot p - \tau_x\cos\beta}{\sigma_z - \sigma}$

4) $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$

$$\begin{bmatrix} \sigma_x-\sigma_1 & \tau_z & \tau_y \\ \tau_z & \sigma_y-\sigma_1 & \tau_x \\ \tau_y & \tau_x & \sigma_z-\sigma_1 \end{bmatrix} \begin{bmatrix} \cos\alpha_1 \\ \cos\beta_1 \\ \cos\gamma_1 \end{bmatrix} = \underline{\emptyset}$$

$$\begin{bmatrix} -24-24{,}8 & 28{,}8 & 30 \\ 28{,}8 & 19-24{,}8 & \emptyset \\ 30 & \emptyset & 28{,}8-24{,}8 \end{bmatrix} \begin{bmatrix} \cos\alpha_1 \\ \cos\beta_1 \\ \cos\gamma_1 \end{bmatrix} = \underline{\emptyset}$$

$$\begin{bmatrix} -48{,}8 & 28{,}8 & 30 \\ 28{,}8 & -5{,}8 & \emptyset \\ 30 & \emptyset & 4 \end{bmatrix} \begin{bmatrix} \cos\alpha_1 \\ \cos\beta_1 \\ \cos\gamma_1 \end{bmatrix} = \underline{\emptyset} \rightarrow \left.\begin{aligned} -48{,}8\cos\alpha_1 + 28{,}8\cos\beta_1 + 30\cos\gamma_1 &= \emptyset \\ 30\cos\alpha_1 + 4\cos\gamma_1 &= \emptyset \\ \cos^2\alpha_1 + \cos^2\beta_1 + \cos^2\gamma_1 &= 1 \end{aligned}\right\} \rightarrow$$

$$② \quad \cos\alpha_1 = \frac{-4\cos\gamma_1}{30} \rightarrow ① \quad -48{,}8\cdot\frac{(-4\cos\gamma_1)}{30} + 28{,}8\cos\beta_1 + 30\cos\gamma_1 = \emptyset \rightarrow$$

$$\rightarrow \quad \rightarrow \cos\beta_1 = \frac{48{,}8\frac{(-4\cos\gamma_1)}{30} - 30\cos\gamma_1}{28{,}8} \rightarrow$$

$$\rightarrow ③ \quad \left(\frac{-4\cos\gamma_1}{30}\right)^2 + \left(\frac{48{,}8\left(\frac{-4\cos\gamma_1}{30}\right) - 30\cos\gamma_1}{28{,}8}\right)^2 + \cos^2\gamma_1 = 1$$

$$\left(\frac{-2\cdot\cos\gamma_1}{15}\right)^2 + \left(\frac{-\frac{488}{75}\cos\gamma_1 - 30\cos\gamma_1}{28{,}8}\right)^2 + \cos^2\gamma_1 = 1$$

$$\frac{4}{225}\cos^2\gamma_1 + \left(-\frac{1369}{1080}\cos\gamma_1\right)^2 + \cos^2\gamma_1 = 1$$

$$\frac{4}{225}\cos^2\gamma_1 + \frac{1874161}{1166400}\cos^2\gamma_1 + \cos^2\gamma_1 = 1 \Rightarrow 2{,}62457\cos^2\gamma_1 = 1$$

$$\boxed{\gamma_1 = 51{,}9^\circ}$$

$$\cos\alpha_1 = \frac{-4\cos\gamma_1}{30} \rightarrow \boxed{\alpha_1 = 94{,}7^\circ}$$

$$\cos\beta_1 = \frac{48{,}8\left(\frac{-4\cos\gamma_1}{30}\right) - 30\cos\gamma_1}{28{,}8} \rightarrow \boxed{\beta_1 = 141{,}5^\circ}$$